

Estimating Philadelphia's Existing and Future Floatables Load to Tookany-Tacony Creek

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Introduction

In PWD's 1995 CSO Documentation of Implementation of the Nine Minimum Controls Plan, PWD recommends that a

... monitoring program be implemented to determine the amount of solids and floatables entering and carried by the sewer system and the receiving waters. Results from the sampling program will be used to determine the required level of control and appropriate technology for implementation both prior-to and during the Long Term Control Plan process. pg. 6-9

In PWD's 1997 Annual CSO Report, PWD reported that the T-04 Pilot Netting Facility

...was built to collect floatable materials for subsequent weighing and disposal so that the relative quantity of floatable materials not captured in the catch basins and with the treatment plant screening could be determined. Similarly, once this balance is determined, the floatables balance for other locations could be inferred from the pilot site. ...The quantity of material collected is now being monitored and a floatable quantification study will be initiated to evaluate the feasibility of any further implementation of this type of control facility".

In PWD's 2000 - 2006 Annual CSO Reports and 2008 to 2010 Annual Wet Weather Reports, PWD reported that

"The City has compared the floatables removed from the net with other floatables control technologies employed. More specifically, on an area weighted basis the inlet cleaning program data suggests that street surface litter dominates the volume of material that can enter the sewer system. The pilot in-line netting system installed at T_4 has been shown to capture debris on the same order as the WPC influent screens indicating that effective floatables control needs to target street surface litter in order to effectively reduce the quantity of debris likely to cause aesthetic concerns in receiving streams."

In the October, 2010 memorandum, PWD reported

"Over the twelve years that the nets have been in operation, we have determined that the outfall nets are not as efficient as previously believed for the PWD system. Although no formal analysis has been conducted on the ratio of organic matter to floatables collected, visual inspection and historic field notes show that the nets mostly collect leaves and very little floatables like cans or bottles. This is mainly because most of the floatables that get in the wastewater system are removed by existing catch basins before they get to the outfalls, so the majority of what the nets collect is organic matter."

PWD's conclusion *that "most of the floatables that get in the wastewater system are removed by existing catch basins before they get to the outfalls.."* is not consistent with my photographic

observations showing floatable debris immediately below 10 of PWD's Tookany & Tacony Creek MS4 and CSO outfalls.

Tookany-Tacony Creek Trash Reduction From the City's GC,CW Program

We have evidence that some of Philadelphia's street litter is passing through the inlet traps, flowing through MS4 and CSO sewers and being discharged to the Tookany-Tacony Creek. What level of creek trash reduction we can expect from the City's GC,CW program?

The MS4 areas will not see any reduction in floatables discharge because whatever floatables passes through the inlet traps will eventually make its way to Tookany-Tacony Creek.

The CSO areas may see some reduction in floatables discharge because a greater portion of CSO area stormwater flows will be captured, possibly reducing the floatable discharge below current levels. For the CSO areas, the critical question is how large will the reduction in floatables discharge be. Will it be sufficient to meet EPA's NMC 6 intent to “.. *reduce, if not eliminate ... visible floatables and solids using relatively simple measures*”?

Other Creek Trash Data Sources

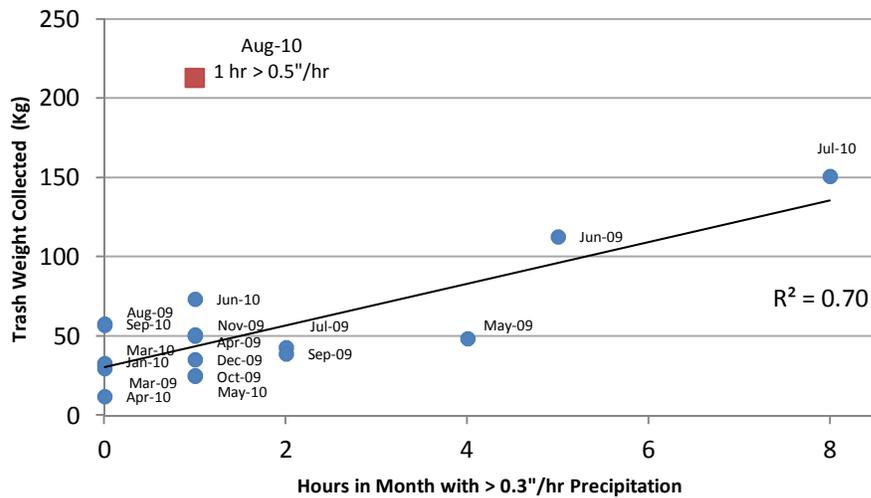
While Philadelphia's T-04 Pilot Netting Study did not produce the necessary data to estimate the future GC,CW program reductions of CSO area floatables discharges, we can use the extensive Anacostia River trash studies to gain some insight into potential creek trash conditions when the GC,CW program is implemented.

The Anacostia Watershed Society (AWS) and the Washington, DC Department of the Environment have conducted a number of studies of creek trash, including a very interesting study of the Nash Run ([link](#)).



The project investigator, Masaya Maeda, measured the trash collected in a custom built trash trap each month between March, 2009 and September, 2010. He found an interesting relationship between the hours per month of intense rainfall ($\times 0.3$ inches/hr) and quantity of trash captured by the trap. The next chart summarizes the Nash Run trash data, it shows the number of hours with 0.3 or more inches per hour precipitation in each month versus the quantity of trash collected by the trap in that month.

Nash Run Trash Trap Project: Captured Trash Amount and Hours of Precipitation > 0.3"/hour in Month

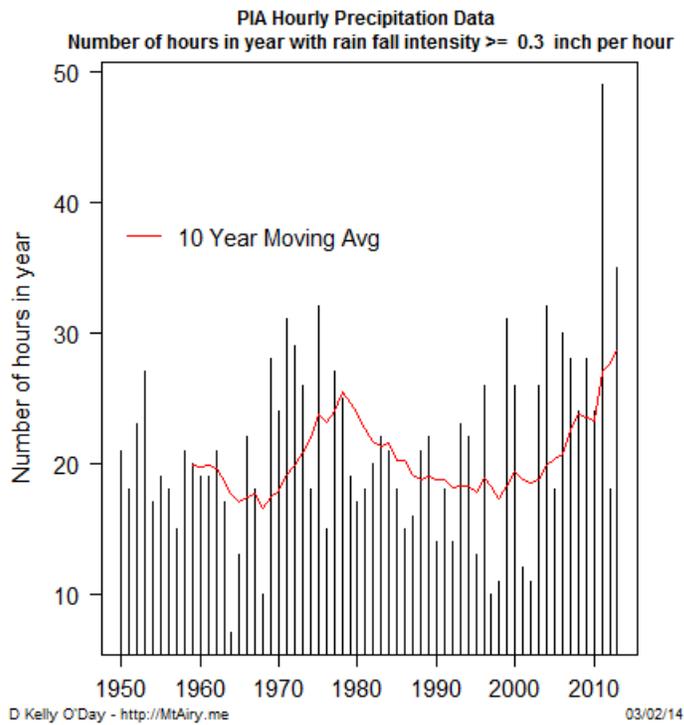


This chart shows that in the Nash Run study area there was a strong relationship between the hours of intense rain ($\times 0.3\ddot{0}/hr$) in a month and the trash collected in the trap during the month. There is only one outlier in the data set, the Aug, 2010 data point. It turns out that there was a rate ($\times 0.5$ inches/hour for one hour), a pretty intense storm that partially explains the specific situation in that month.

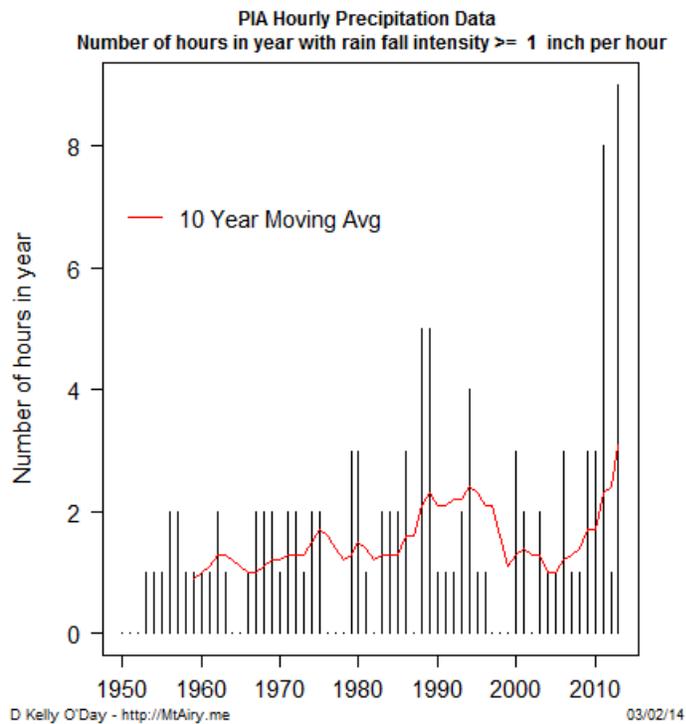
Maeda, the principal investigator, reports $\ddot{0}$. *it is observed that the rainfall intensity larger than 0.3 inches/hour may be a tipping point to carry trash pieces into a nearby stream.*” (pg 5- 7)

Philadelphia Rainfall Patterns

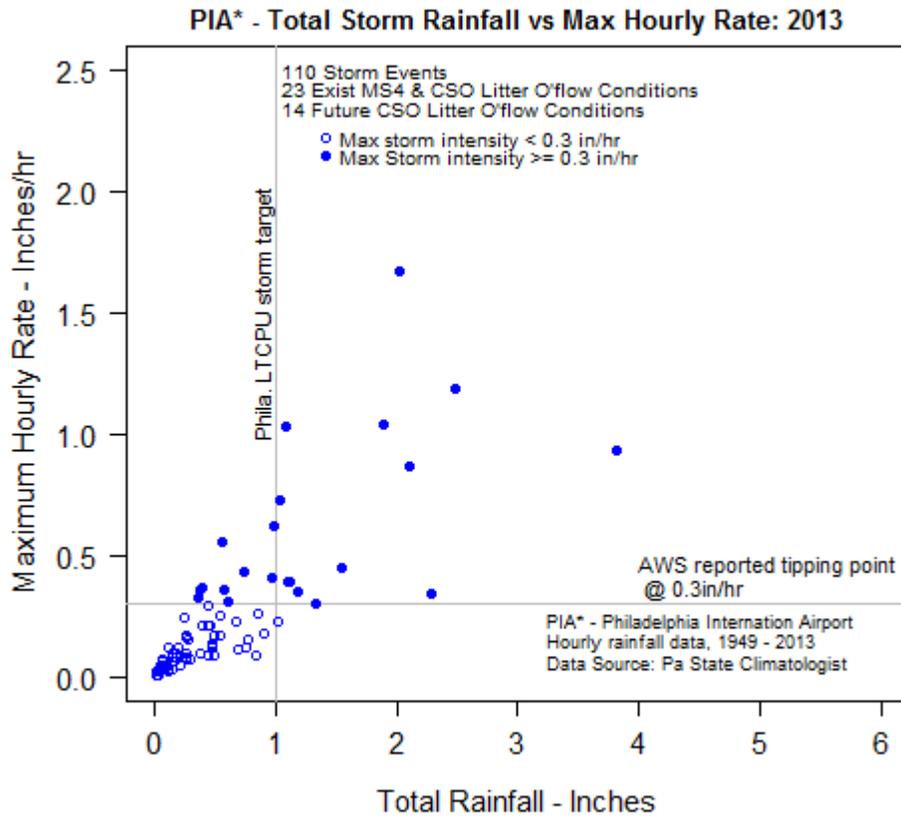
Let’s take a look at Philadelphia rainfall patterns to see how often the rainfall intensity is 0.3 inches per hour or more. The next plot shows the number of hours per year between 1950 to 2013 when the rainfall rate was greater than or equal to 0.3 inches/hour at Philadelphia International Airport.



The number of hours of rainfall intensity (\times 0.3 inches per hr) ranges from a low of 7 to a high of 49 hours per year. This next chart shows the number of hours per year when the rain intensity was 1.0 inches per hour or more.



The next plot is a storm event chart which shows the maximum hour precipitation and total rainfall depth for each of the 110 storms in 2013.



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This storm event chart shows that in 2013, 23 storms had maximum rainfall intensities $\times 0.3\text{in/hr}$. Using the AWS tipping point of 0.3in/hr , these 23 storms had sufficient intensity to move street litter to the sewer systems. If PWD's GC,CW program was fully implemented and able to fully retain 1-inch total depth storms, the MS4 areas would still have discharged floatables during the 23 storms. The CSO areas would have discharged floatables in at least 14 of the 23 storms.

Tookany – Tacony Floatables Control Program

Litter generation and movement in a drainage area and discharge to the receiving creek are affected by a number of factors:

- Land cover upstream of discharge point (paving, slope, vegetation cover, housing density, commercial activity)
- Littering, illegal dumping practices of drainage area residents and visitors
- Street sweeping, litter removal activities and effectiveness in the drainage area
- Type of remaining litter exposed to stormwater conditions. Plastic bottles, Styrofoam cups, plastic bags have different water flow movement characteristics.
- Nature of stormwater system (CSO or MS4)
- Rain fall patterns

PWD has not measured or quantified floatables loads by rainfall event study so we don't have data comparable to the AWS rainfall intensity & trash load data. We don't know if the AWS 0.3 in/hr litter tipping concept is appropriate for Tookany & Tacony conditions. We do know that we have significant trash loads in the Tookany Tacony Creek. We have 7 & 49 hours of intense rainfall ($\times 0.3$ in/hr) per year.

We need rigorous street litter & creek trash studies like those conducted by AWS and Washington, DC to understand the litter & trash stormwater movement conditions in the Tookany & Tacony watershed and to be able to develop a specific floatables control program for the Tookany & Tacony Creek.